C1 Exercise 1B

1 $x^3 \times x^4 \equiv x^7$

Indices are mad,
To multiply you add.

$$x^3 \times x^4 \equiv (x \times x \times x) \times (x \times x \times x \times x)$$
$$\equiv x \times x \times x \times x \times x \times x \times x$$
$$\equiv x^7$$

Can you see why the rule works?

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2 $2x^3 \times 3x^2$

$\equiv 2 \times 3 \times x^3 \times x^2$

$\equiv 6 \times x^5$ indices are mad...

$= 6x^5$

So in short, multiply the '<u>coefficients</u>' (that is the numbers in front of the letters) and use the rule to add the indices

$$2x^3 \times 3x^2 = 6x^5$$

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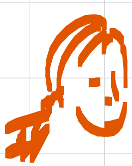
3 $\quad 4p^3 \div 2p \equiv \dfrac{\overset{2}{\cancel{4}} \times p \times p \times \cancel{p}}{\underset{1}{\cancel{2}} \times \cancel{p}} \equiv 2p^2$

Again divide the coefficients, but this time use the rule:

Indices are cracked,

To divide you must subtract.



Here $\quad p^3 \div p \equiv p^3 \div p^1 \equiv p^{(3-1)} \equiv p^2$

Note p^1 and p are the same. Why?

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4 $\quad 3x^{-4} \div x^{-2} = 3x^{(-4 - -2)} = 3x^{-2} \equiv \dfrac{3}{x^2}$

$x^1 \equiv x$ because $\dfrac{x^3}{x^2} = x^1$ by the rule,

$\equiv$ means 'IDENTICAL' not just equal.

but also $\dfrac{x \times \cancel{x} \times \cancel{x}}{\cancel{x} \times \cancel{x}} = x$ so $x^1 \equiv x$

$x^0 \equiv 1$ (whatever x is, except $x = 0$. Why not?)

because $x^0 \equiv \dfrac{x^2}{x^2} \equiv \dfrac{{}^1\cancel{x} \times \cancel{x}}{{}_1\cancel{x} \times \cancel{x}} \equiv 1$

$x^{-2} \equiv \dfrac{1}{x^2}$ etc because $x^{-2} \equiv \dfrac{x^3}{x^5} \equiv \dfrac{{}^1\cancel{x} \times \cancel{x} \times \cancel{x}}{x \times x \times \cancel{x} \times \cancel{x} \times \cancel{x}} \equiv \dfrac{1}{x^2}$

5 $k^3 \div k^{-2} = k^{(3 - {}^-2)} = k^5$

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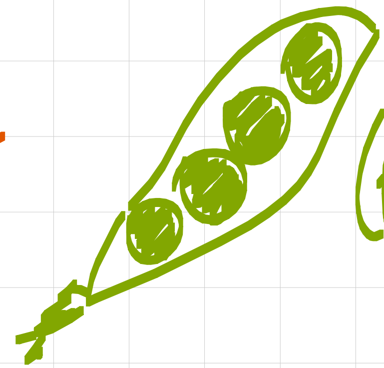
6 $(y^2)^5 = (y \times y)^5 = (y \times y) \times (y \times y) \times (y \times y) \times (y \times y) \times (y \times y)$

so $(y^2)^5 = y^{10}$

This leads us to the 4 P's rule

A **P**ower of a **P**ower
Is the **P**roduct of the **P**owers



(four peas!)

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7 $10x^5 \div 2x^{-3} = \dfrac{10x^5}{2x^{-3}} = \dfrac{10x^5 \times x^3}{2} = 5x^8$

(Alternative method use the COMMUTATIVE RULE* for multiplication to write

$$10x^5 \div 2x^{-3} \equiv (10 \div 2) \times (x^5 \div x^{-3})$$
$$\equiv 5 \times x^8$$
$$\equiv 5x^8$$
)

* The COMMUTATIVE RULE says $a \times b \equiv b \times a$ for all values of a and b.

Eg. $17 \times 13 = 221$ so $13 \times 17 = ?$

8 $(p^3)^2 \div p^4 \equiv \dfrac{p^6}{p^4} \equiv p^2$

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9 $\quad (2a^3)^2 \div 2a^3 \equiv \dfrac{2a^3 \times \cancel{2a^3}}{\cancel{2a^3}} \equiv 2a^3$

Sometimes it pays to think about what you're doing!

Above you MIGHT have worked out:

$$\frac{(2a^3)^2}{2a^3} = \frac{4a^6}{2a^3}^{*} = \left(\frac{4}{2}\right) \times \left(a^6 \div a^3\right) = 2a^3$$

... but you'd have wasted precious seconds of your life.

Notice the term in brackets to be squared is the same as the divisor & cancel them out.

* Note in $(2a^3)^2$ the 2 gets squared as well as the a^3.

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10 $8p^{-4} \div 4p^{3} = 2p^{-7}$

$8 \div 4$ $\quad$ $p^{(-4-3)}$ using "indices are cracked"..

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11 $2a^{-4} \times 3a^{-5} = 6a^{-9}$

$$= \frac{6}{a^9}$$

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12 $\quad 21a^3b^2 \div 7ab^4 \equiv 3a^2b^{-2}$

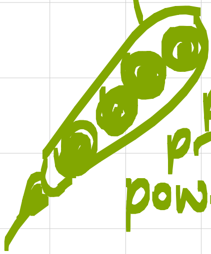
don't forget this is a^1

Now you can think $a^3 \div a^1 \equiv a^{3-1} \equiv a^2$

C1 Ex1B

13 $9x^2 \times 3(x^2)^3 = 9 \times 3 \times x^2 \times x^6$

$= 27x^8$



power of a power is the product of the powers

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14 $3x^3 \times 2x^2 \times 4x^6 \equiv 3 \times 2 \times 4 \times x^3 \times x^2 \times x^6$ *

$\equiv 24\,x^{(3+2+6)}$

$\equiv 24\,x^{11}$

* Repeated use of commutative property. See Q7.

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15 $7a^4 \times (3a^4)^2 \equiv 7 \times 3^2 \times a^4 \times (a^4)^2$

$\equiv (7 \times 9) \times (a^4 \times a^8)$

$\equiv 63a^{12}$

Remember, when the term to be squared (or raised to any other power) is a complicated bit in brackets, you've got to square (etc) EVERY part of it.

Eg: $(pqr)^n \equiv p^n q^n r^n$

$(2y)^{10} \equiv 2^{10} y^{10} \equiv 1024y^{10}$.

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16 $$(4y^3)^3 \div 2y^3 \equiv \frac{4^3 \times (y^3)^3}{2 \times y^3} \equiv \frac{64}{2} \times \frac{y^9}{y^3}$$

$$\equiv 32y^6$$

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17 $\underline{2a^3 \div 3a^2} \times \underline{6}a^5 \equiv \dfrac{2a^3}{3a^2} \times 6a^5$

$\equiv \dfrac{2 \times \cancel{6}2 \times a^{\cancel{3}1} \times a^5}{\cancel{3} \times \cancel{a^2}}$

$\equiv 4a^6$

It's subtle, but in BO$\boxed{\text{DM}}\boxed{\text{AS}}$, you should, of course do Brackets first, then Other stuff like powers and roots...

But Division & Multiplication should be done SIMULTANEOUSLY from left to right, as should Addition & Subtraction.

18 $3a^4 \times 2a^5 \times a^3 \equiv 6a^{(4+5+3)} \equiv 6a^{12}.$